Eric Keith
Botantist/Plant Ecologist
24 Summer Place
Huntsville, TX 77340
Tel. (936) 438-6328
Email: ek7275@suddenlink.net

June 20, 2014

George Russell
1401 19th Street
Huntsville, Texas 77340

Dear Mr. Russell:

This letter includes the results of a plant survey and recommendations for management along the section of Waterwood Parkway from FM 980 to the end of the road at the former location of the clubhouse. This right-of-way (ROW) easement is referred as "the Russell leased Parkway" in the "Agreement to Lease and Maintain Waterwood Parkway" document signed by you and Mrs. Suzanne Russell with the Waterwood Improvement Association Inc. (WIA) president, Jack Zimmerman. The effective date of this document is June 1, 2012.

On June 20, 2014, I met with you and two of your employees to record all identifiable vascular plant species along "the Russell leased Parkway", hereafter referred to as ROW. We walked approximately ¼ mile along the ROW recording all identifiable species. Once most of the obvious species had been recorded, we then drove the remaining sections of the ROW recording any new species not previously identified. The soils along the ROW are predominantly sandy loam uplands with scattered small marshy areas. The two dominant species along the ROW are the non-native exotic species (NNIS) bahia grass (*Paspalum notatum*) and native perennial species Texas wintergrass (*Nassella leucotricha*). Other perennial native grasses are also beginning to colonize the ROW, particularly in areas that haven't been mowed as frequently. These species include little bluestem (*Schizchyrium scoparium*), bushy bluestem (*Andropogon glomeratus*), switchgrass (*Panicum virgatum*), and Eastern gammagrass (*Tripascum dactyloides*). In addition, fall blooming forbs such as three species of aster (*Symphyotrichum* spp) and two species of goldenrod (*Solidago* spp) are also colonizing many areas that afford some protection from frequent mowing. Of particular interest was Sampson's snakeroot (*Orbexilum pedunculatum*), which is uncommon and rarely encountered, except in relatively undisturbed habitats. This species was only observed under existing overstory trees where mowing has occurred much less frequently. A total of 131 native species were observed along the ROW including many species that bloom in late summer and fall. A total of 14 NNIS were also observed, primarily in areas immediately adjacent to the road that are frequently mowed. In my experience, frequently mowed areas and other highly disturbed areas are more susceptible to NNIS encroachment while less frequently mowed areas allow native species to propagate and thrive.

According to the lease agreement on page 6, mowing shall be done subject to the Texas Department of Transportation (TXDOT) Roadside Vegetation Manual. According to this

manual and along "Developed Urban Highways" (defined as rights of way within smaller cities, towns and villages), TXDOT is directed to "Establish non-mow or natural areas at appropriate locations within the right of way, to provide for wildflower preservation, regeneration of native plant species and establishment of nesting habitat for wildlife". These areas should be "clearly marked to prevent accidental mowing during modified full-width mowing." Given that this stipulation is the directive of TXDOT in its manual and WIA agreed to follow this manual in the lease agreement, it is my recommendation to set aside areas for regeneration of native plant species that are currently present and rapidly colonizing in less frequently mowed areas. In my professional opinion, in order for this agreement to follow the guidelines outlined the TXDOT manual, a native plant regeneration area should be established since numerous native species are currently present and colonizing the ROW. Perhaps, a suitable compromise for the lease agreement would be to mow one mower width immediately along the roadside once in the growing season and again mow the entire ROW in late fall or winter when all native species have gone to seed.

My qualifications to complete this survey are as follows. I received my Bachelor of Science degree in Environmental Science from Stephen F. Austin State University in 1995 and have worked for more than nineteen years as a botanist and plant ecologist including three years at the Environmental Division of Fort Polk Military Installation in Louisiana and the last sixteen years at Raven Environmental Services, Inc in Huntsville, TX. I have conducted plant inventories, rare plant surveys, and ecological classifications on over 20,000 acres for Texas Parks and Wildlife, U.S. Department of Defense, City of Austin, and over a dozen large and small private landowners in Texas and the Southeastern U.S. Please see attached resume.

Please let me know if you have any questions or concerns or need any additional information. Thank you for the opportunity of completing this survey, and please let me know if you need any assistance on future projects.

Sincerely,

Eric L. Keith

Eric L. Keith
Botanist/Plant Ecologist

Attachments:

Keith Resume
List of Plants Recorded During Survey

Eric Keith – Ecologist
24 Summer Place
Huntsville, TX 77340
Email: ek7275@suddenlink.net

B.S., Environmental Science, Stephen F. Austin State University. Nineteen years experience in management of endangered species and sensitive plant communities, specializing in plant identification, rare plant surveys, plant community delineation and management, and wetlands delineation.

PAST PERFORMANCE AND EXPERIENCE

1. Since 1998, I have completed Federal and State listed Threatened, Endangered and Sensitive (TES) species surveys and reports required for dozens of Biological Assessments and Evaluations and have performed for a variety of clients and projects on private and federal lands. I have recorded numerous undocumented endangered species locations throughout public and private properties and addressed a wide range of TES species issues associated with these projects. Some of the clients I have worked for include:

    - Environmental Division, Fort Polk Military Reservation, LA
    - Temple-Inland Forest Products Corporation Inc.
    - U.S. Forest Service
    - Texas Parks and Wildlife Department
    - The Nature Conservancy
    - Cooks Branch Conservancy
    - City of Austin

2. Since 2000, I have worked with Texas Parks and Wildlife Department installing and sampling over 200 permanent vegetation plots and identifying any and all rare plant associations and associated rare species on 65 state parks. I have used Global Position Systems (Trimble Geo Explorer 3, Trimble GeoXT, several Garmin devices) and ArcView© software to develop these vegetative cover maps and record and map all rare plant species and rare plant community locations in the parks.

3. From 2001 to present, I have conducted rare species and plant association surveys on over 20,000 acres of private property owned by Temple-Inland Forest Products Corporation (Temple) for the purpose of compliance with forest certifications. I identified and mapped using GPS technology and ARCView software over 100 new rare plant locations and over 100 new rare plant association locations. Twelve of these rare plant associations were undescribed according to Nature Serve. I provided the data to Nature Serve and the data has been incorporated into their website database.

4. I have published sixteen peer reviewed articles in eight different journals that included distributional data for rare, threatened, and endangered plant species and one previously undescribed species, *Yucca cernua* Keith.

5. In June of 2004 I surveyed nearly 700 acres in the Sabine National Forest for any undocumented TES animal and plant species in preparation for a timber sale. I documented three unknown red-cockaded woodpecker (RCW) (*Picoides borealis*) trees and one unique blackland prairie plant community in the survey area. I collected GIS data for each and provided the USFS with a map of the survey results and the raw GIS data.

6. From March 2005 – November 2011, I installed and sampled 38 long-term monitoring plots on Fort Polk Military Reservation in Vernon Parish, LA. These monitoring plots recorded changes in vegetation occurring from military training, forest management, climate change, etc. Survey locations for small mammals, Bachman's and Henslow's sparrows, and pocket gophers were also tied into the vegetation monitoring plots to determine the effects of these species to changes in vegetation.

7. Currently, I am working with City of Austin installing long-term monitoring plots and mapping vegetation and fuel models on four city parks. This project was the first ecological project initiated by the City of Austin and was designed following my recommendations.

8. Currently, I am coordinating and managing a cooperative project between Cook's Branch Conservancy (Montgomery County, Texas) and US Fish and Wildlife Service (Partners for Fish and Wildlife) to restore native grasses and forbs on approximately 140 acres of presently improved pasture. Restoration will be accomplished with a combination of herbicide application, planting with a mix of native grass and forb seeds, and controlled burning. I also installed forty-two permanent vegetation monitoring plots to quantify changes in vegetation from management activities.

REFERENCES

1. Kathy Hutson – Ranch Manager
   Cook's Branch Conservancy
   8280 FM 149
   Montgomery, Texas 77316

   Ph: (281) 723-6812
   Fx: (936) 597-5006
   Email: cooksbranch@earthlink.net

2. Jeff Sparks – Natural Resources Coordinator
   Texas Parks and Wildlife Department
   11942 FM 848
   Tyler, TX 75707

   Ph: (903) 566-5698
   Fx: (903) 566-7853
   Email: jeff.sparks@tpwd.state.gov

List of Species Recorded along "the Russell leased Parkway"

Acanthaceae	Ruellia humilis	Native
Anacardiaceae	Toxicodendron radicans	Native
Apiaceae	Hydrocotyle verticillata	Native
Apiaceae	Polytaenia texana	Native
Apiaceae	Ptilimnium capillaceum	Native
Apiaceae	Ptilimnium nuttallii	Native
Apocynaceae	Trachelospermum difforme	Native
Aquifoliaceae	Ilex vomitoria	Native
Asclepiadaceae	Asclepias tuberosa	Native
Asclepiadaceae	Asclepias verticillata	Native
Asclepiadaceae	Asclepias viridis	Native
Asteraceae	Ambrosia psilostachya	Native
Asteraceae	Boltonia diffusa	Native
Asteraceae	Chrysopsis pilosa	Native
Asteraceae	Chrysopsis texana	Native
Asteraceae	Cirsium horridulum	Native
Asteraceae	Coreopsis lanceolata	Native
Asteraceae	Echinacea sanguinea	Native
Asteraceae	Englemannia peristenia	Native
Asteraceae	Erigeron strigosus	Native
Asteraceae	Eupatorium coelestinum	Native
Asteraceae	Eurybia paludosa	Native
Asteraceae	Gaillardia pulchella	Native
Asteraceae	Helenium amarum	Native
Asteraceae	Helenium flexuosum	Native
Asteraceae	Hymenopappus artemisiifolius	Native
Asteraceae	Liatris aspera	Native
Asteraceae	Liatris pycnostachya	Native
Asteraceae	Pityopsis graminifolia	Native
Asteraceae	Pseudognaphlium obtusifolium	Native
Asteraceae	Pyrrhopappus carolinianus	Native
Asteraceae	Rudbeckia hirta	Native
Asteraceae	Rudbeckia grandiflora	Native
Asteraceae	Solidago radula	Native
Asteraceae	Solidago ulmifolia	Native
Asteraceae	Symphyotrichum dumosum	Native
Asteraceae	Symphyotrichum patens	Native
Asteraceae	Symphyotrichum subulatum	Native
Bignoniaceae	Campsis radicans	Native
Campanulaceae	Triodanis biflora	Native
Caprifoliaceae	Symphiocarpos orbiculatus	Native
Cistaceae	Lechea mucronata	Native
Cistaceae	Lechea tenuifolia	Native
Clusiaceae	Hypericum hypericoides	Native
Commelinaceae	Commelina erecta	Native
Convolvulaceae	Dichondra carolinense	Native

Convolvulaceae	Ipomoea cordatotriloba	Native
Convolvulaceae	Stylisma humistrata	Native
Cyperaceae	Carex bushii	Native
Cyperaceae	Carex cherokeensis	Native
Cyperaceae	Carex flaccosperma	Native
Cyperaceae	Eleocharis montevidensis	Native
Cyperaceae	Rhynchospora caduca	Native
Cyperaceae	Rhynchospora globularis	Native
Ebenaceae	Diospyros virginiana	Native
Ericaceae	Vaccinium arboreum	Native
Euphorbiaceae	Acalypha gracilens	Native
Euphorbiaceae	Chamaesyce maculata	Native
Euphorbiaceae	Croton glandulosus	Native
Euphorbiaceae	Croton monathogynus	Native
Fabaceae	Baptisia nuttaliana	Native
Fabaceae	Cassia fasciculata	Native
Fabaceae	Galactia volubilis	Native
Fabaceae	Gleditsia triacanthos	Native
Fabaceae	Indigofera miniata	Native
Fabaceae	Lespedeza repens	Native
Fabaceae	Mimosa nuttallii	Native
Fabaceae	Neptunia lutea	Native
Fabaceae	Orbexilum pedunculatum	Native
Fabaceae	Strophostyles umbellata	Native
Fabaceae	Stylosanthes biflora	Native
Fagaceae	Quercus marilandica	Native
Fagaceae	Quercus nigra	Native
Fagaceae	Quercus stellata	Native
Juncaceae	Juncus brachycarpus	Native
Juncaceae	Juncus validus	Native
Lamiaceae	Monarda citriodora	Native
Lamiaceae	Physostegia digitalis	Native
Lamiaceae	Prunella vulgaris	Native
Liliaceae	Nothoscordum bivalve	Native
Linaceae	Linum medium	Native
Loganiaceae	Gelsemium sempervirens	Native
Malvaceae	Callirhoe papaver	Native
Melastomataceae	Rhexia mariana	Native
Menispermaceae	Cocculus caroliniana	Native
Nyssaceae	Nyssa sylvatica	Native
Onagraceae	Oenothera laciniata	Native
Onagraceae	Oenothera speciosa	Native
Oxalidaceae	Oxalis dilleni	Native
Passifloraceae	Passiflora lutea	Native
Pinaceae	Pinus echinata	Native
Pinaceae	Pinus palustris	Native
Pinaceae	Pinus taeda	Native
Plantaginaceae	Plantago aristata	Native

Plantaginaceae	Plantago virginica	Native
Poaceae	Andropogon glomeratus	Native
Poaceae	Aristida oligantha	Native
Poaceae	Dichanthelium aciculare	Native
Poaceae	Dichanthelium acuminatum	Native
Poaceae	Dichanthelium depauperatum	Native
Poaceae	Dichanthelium ravenelii	Native
Poaceae	Dichanthelium sphaerocarpon	Native
Poaceae	Elymus virginicus	Native
Poaceae	Nassella leucotricha	Native
Poaceae	Panicum virgatum	Native
Poaceae	Paspalum setaceum	Native
Poaceae	Schizachyrium scoparium	Native
Poaceae	Sorghastrum nutans	Native
Poaceae	Tridens flavus	Native
Poaceae	Tripascum dactyloides	Native
Portulacaceae	Portulaca pilosa	Native
Rosaceae	Crataegus marshallii	Native
Rosaceae	Crataegus spathulata	Native
Rosaceae	Rubus louisianus	Native
Rosaceae	Rubus trivialis	Native
Rubiaceae	Diodia teres	Native
Rubiaceae	Diodia virginiana	Native
Saxifragaceae	Lepuropetalon spathulatum	Native
Smilacaceae	Smilax bona-nox	Native
Smilacaceae	Smilax glauca	Native
Smilacaceae	Smilax smallii	Native
Ulmaceae	Ulmus alata	Native
Verbenaceae	Callicarpa americana	Native
Verbenaceae	Phyla nodiflora	Native
Violaceae	Viola sororia	Native
Vitaceae	Parthenocissus quinquefolia	Native
Vitaceae	Vitis cinerea	Native
Vitaceae	Vitis rotundifolia	Native
Poaceae	Bothriochloa laguroides	Native
Poaceae	Paspalum plicatulum	Native
Verbenaceae	Verbena halei	Native
Apocynaceae	Nerium oleander	Non-native
Asteraceae	Facelis retusa	Non-native
Fabaceae	Kummerowia striata	Non-native
Fabaceae	Trifolium lappaceum	Non-native
Poaceae	Aira elegans	Non-native
Poaceae	Bothriochloa ischaemum	Non-native
Poaceae	Briza minor	Non-native
Poaceae	Bromus japonicus	Non-native
Poaceae	Paspalum dilatatum	Non-native
Poaceae	Paspalum notatum	Non-native
Poaceae	Paspalum urvillei	Non-native

Poaceae	Sorghum halapense	Non-native
Poaceae	Stenotaphrum secundatum	Non-native
Verbenaceae	Verbena rigida	Non-native

Section 2: Preserving and Enhancing Habitat

Strive for Diversity

Any vegetated area provides food and cover for at least some wildlife species. If plant diversity is restricted, however, wildlife diversity will also be limited. Different animals require different habitats. Plant diversity is essential to maintaining an abundant and varied wildlife population.

Growth structure is another important factor affecting the quality of wildlife habitats. "Growth structure" simply refers to the height and coverage of the vegetative canopy. Promoting a diverse vegetative growth structure will also encourage wildlife diversity.

Diversity – both in plant variety and growth structure – is the key to preserving and enhancing wildlife habitat. Roadside vegetation management efforts, therefore, should focus on encouraging a *diverse* native plant population that will provide abundant food and cover for a variety of wildlife.

Mow Wisely

Intensive Agricultural Areas: In intensive agricultural areas, monocultural row crops dominate. These areas include the Texas panhandle, middle Gulf coast and blackland prairie regions. In these areas, the only suitable nesting habitat for upland birds is within highway rights of way. The timing and frequency of mowing schedules in these areas dramatically affects nesting success. Studies have shown that infrequent mowing (or not mowing at all in some cases) increases the value of the roadsides to nesting wildlife, especially birds and small mammals.

Wetlands: Roadsides prone to inundation or saturation during the spring and summer can serve as valuable habitat when managed properly. Allowing the growth of wetland vegetation in these areas will contribute to the nesting success of waterfowl and also provide feeding habitat and escape cover for shorebirds, wading birds and many reptiles and amphibians.

Rangelands: Roadsides are especially important to wildlife in rangeland areas subjected to continuous livestock grazing. Since boundary fences normally keep domestic livestock off the right of way, the roadsides in these areas usually provide a higher diversity of grasses and forbs than the heavily-grazed adjacent lands.

During late fall and winter, heavily grazed pastures and cultivated farmlands don't provide suitable food and cover for species of birds and small mammals. However properly maintained rights of way can provide some cover to wildlife species (such as pheasants) that have narrow food and cover requirements.

Bottom Line: Establish non-mow areas and adjust schedules to accommodate wildlife whenever possible.

Use Trees and Shrubs

Incorporating woody shrubs and trees into the roadside environment will provide additional sources of food, escape cover, nesting cover and roosting areas for wildlife. Texas roadsides present many opportunities for habitat enhancement in areas where such vegetation has been cleared or is otherwise lacking.

In the high plains of the Texas panhandle or rolling plains of north Texas, woody species along roadsides will also serve as living snow fences and windbreaks to help prevent drifts across roadways.

In areas with highly erodible soil or blowing sand and dirt, woody plants can also provide superb erosion control.

Nurture Seeds

Over the years in many areas, land use practices have inhibited the growth of specific native plants. One reason this happens is because plants are not allowed to die off naturally and provide seed for the next generation. This process is particularly important in maintaining grass and forb species that depend on seed dispersal.

Roadsides, which have been free of intensive farming, human habitation and domestic livestock grazing, typically harbor more diverse plant communities than adjacent lands. With proper management, roadsides will serve as a source of seeds. These seeds will be windblown or distributed by wildlife into adjacent lands to support natural plant regeneration. In many areas of Texas, roadsides represent the *only possible source* for natural regeneration.

Roadside vegetation management practices should encourage seed production and proper dispersal by:

- properly selecting native and introduced plants and
- adjusting mowing schedules to allow for seed production and dispersal.

Encourage Wildflowers

We all know how popular wildflowers have become among the traveling public. Our colorful roadsides have brought on a real public relations success. They've generated favorable media coverage and prompted requests from motorists for routes and locations for best viewing.

What may be less understood about our native wildflowers is how beneficial they are to wildlife. Wildflower seeds provide food for many wildlife species, including birds and small mammals. The plants also participate in an intricate food web, supporting many insects and other invertebrates that other wild animals depend upon.

Roadsides typically sustain a greater density and variety of wildflowers than adjacent pastures and fields. So wildflowers represent just one more reason why roadsides are important in our efforts to enhance biological diversity.

Encouraging roadside wildflowers strengthens wildlife diversity.

Roadsides and Endangered Species

Roadsides free from disturbances occurring on adjacent lands can be managed as refuges for the preservation of threatened or endangered plants and sensitive ecosystems. TxDOT and the Texas Parks and Wildlife Department (TPWD) have interagency agreements to identify sensitive plants and develop appropriate management plans. Roadsides can also be managed to enhance habitat for threatened or endangered wildlife. Such roadsides would be particularly valuable in regions where existing potential habitat is scarce.

Chapter 3: Native and Introduced Grasses, Wildflowers and Legumes

Section 1: Overview

Background

The Texas Department of Transportation has received national recognition for its roadside wildflower program. Since 1929, the department has maintained the practice of withholding mowing until wildflowers have set mature seed and expanding the range of wildflower species.

In addition to beautifying the right of way, wildflowers – along with native and introduced grasses and legumes – contribute to the overall health of the plant community by providing specific soil nutrients. Preservation and propagation of these plants continues to be an important part of the department's vegetation management strategy.

Planting roadsides with mixtures of native and introduced grasses, legumes and wildflowers adheres to the department's policy of:

- providing a safe and comfortable road network for the traveling public
- enhancing environmental protection and developing over 800,000 acres of roadside wildlife habitat
- reducing erosion losses of topsoil and borrow material
- providing cost-efficient maintenance activities.

Benefits

The use of wildflowers with a specific grass mixture for a localized area (*Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, Item* 164) will:

- help blend highway right of way into adjacent lands
- reduce maintenance costs
- reduce erosion rates
- improve aesthetic beauty
- add to the value of roadsides as wildlife habitat.

General Nature of Information

The information contained in this chapter is very general and may not apply to all species. Additional research may be necessary to obtain information on specific species.

Section 3: Changing Attitudes

Wildlife Density and Safety

Studies suggest that roadside management practices have little influence on roadkill. The main factors are the types and conditions of habitats on adjacent lands and associated wildlife population densities on those lands. Deer prefer established travel corridors. Their movement patterns are based on the available cover and the juxtaposition of favored habitats. A greater frequency of road crossings will occur where a highway intersects these preferred habitats. Other species of wildlife that typically use established corridors include raccoons, skunks, opossums, squirrels, coyotes, bobcats and some songbirds. These animals are likewise vulnerable to roadkill. Road crossings at creek and river drainages are good examples of this relationship. A greater frequency of auto collisions would occur in this situation *regardless* of the roadside vegetation management practices.

Consider placing signs to warn motorists at known or expected wildlife-vehicle collision locations.

Public Perceptions of Unmowed Roadsides

An interview of motorists conducted at a rest stop along an interstate highway in North Dakota in 1971 (Oetting and Cassel) provided some insight into public perceptions of unmowed roadsides. The rest area was at the end of a segment of highway featuring both mowed and unmowed roadsides. Most of the motorists (82 percent) did not notice any difference between the areas. When interviewers pointed out the two conditions, 72 percent stated they preferred the mowed strips, because they were neater. However, when briefed on the effects the mowed roadsides had on wildlife, many respondents wanted to change their answer, because of their positive feelings toward wildlife.

This research suggests that publicity programs and highway signs can increase support of roadside management programs.

Sample News Release

The sample news release (following page) shows one way to explain new mowing practices to the public.

Section 4: Special Situations

Overview

This section covers special situations that may be encountered on the right of way.

Manicured Areas

Manicured areas are generally maintained under separate landscape maintenance contracts.

Grass Establishment

In areas of new construction or anywhere newly seeded, sprigged, plugged, or turfed right of way is being established, frequent mowing may be necessary to reduce competition from weeds and noxious grasses. However, native grasses must be managed somewhat differently from the more conventional introduced species like fescues and bermudagrass.

Native Grasses

To avoid weakening a stand of native grasses, it is important that they not be cut too short or too often. Frequent mowing of native grasses would allow noxious weeds to invade. Once established, native warm season grasses (bluestems, gramas, green sprangletop, and plains bristlegrass) should be cut no lower than seven inches to ensure survivability.

Chapter 5: Vegetation Management and Wildlife Habitat

Section 1: Overview

Background

More than 800,000 acres of roadsides associated with Texas highways are vegetated. Most of these acres will be under vegetation management level 2 (as described in Chapter 1). These rights of way include all ecological regions of Texas and represent a cross-section of the state's varying landscapes. They range from humid prairies and forests in the southeast and east to desert shrub, grassland and forests in the mountainous region of west Texas.

These landscapes support more than 900 species of wildlife and about 5,500 species of vascular plants including 2,000 different wildflowers. Because roadsides within these landscapes provide habitat for a wide variety of plants and wildlife, they are vital to their continued existence.

This section explains why the rich natural resource heritage found along roadsides should be conserved and managed as a part of the Texas highway system.

Threat of Habitat Degradation

Habitat degradation and loss is now the most significant problem associated with maintaining healthy populations of wildlife and plant resources. The adverse effects of habitat destruction have become a national and global concern.

Extent of Habitat Degradation

More than one-half of the wetland habitats in the continental United States have disappeared. Land use changes have resulted in similar losses of coastal wetlands in Texas. Almost two-thirds of hardwood bottomlands (one of the more important habitats) are now gone. In the lower Rio Grande Valley, more than 95 percent of native brush has vanished. Native longleaf pine forests have declined from an estimated six million acres to less than one million acres. Some 95 percent of the originally occurring native prairies have also disappeared.

Remaining habitats have suffered too. Human development has fragmented them. Poor land management practices have modified them. And the introduction of exotic plants and animals has displaced native species.

Significance of Roadsides

As native wildlife and plant habitats continue to decline, those that do remain gain importance. Remaining habitats are important both to the resources dependent on them and to the public.

Increasingly, the public views natural resources as part of our Texas heritage. Thus roadsides, through their permanence and statewide distribution, have gained importance as plant and wildlife habitat.

Section 6: Other Precautions

Overview

The main purpose of the vegetative cover on the right of way is to protect the roadside from erosion. Left unprotected, deterioration would occur, threatening the paved surface of the roadway. Mowing is an important component of roadside vegetation management, but it must be conducted with care to preserve the vegetative cover. Observing the precautions contained in this section will help:

- ensure efficient and environmentally sound mowing operations
- promote wildlife habitat
- maintain seed sources for the state's native flora.

Delay Mowing When Soil Is Wet

When the soil is wet, delay mowing. Tractor tires cause severe rutting in wet soil as shown in Figure 2-15. Rutting, especially on slopes, causes erosion and leads to the spread of noxious weeds. Erosion leads to deterioration of the roadside and threatens the paved surface of the roadway.

Avoid Mowing Steep Slopes

Avoid mowing steep slopes (3:1 ratio or steeper), even in urban areas, whenever possible. Mowing steep slopes increases compaction, causes slope failure and rutting and decreases the vigor of the vegetation. Loss of plant growth results in slope erosion.

Figure 2-15. Mowing steep slope (rutting and slope failure).

Use Appropriate Cutting Height

Never set mower cutting height lower than seven inches in rural areas and five inches in urban areas.

Low cutting (also called "scalping") is undesirable because it:

- produces stress in the vegetation, especially during dry, hot conditions, resulting in loss of desirable vegetative cover
- deprives ground-nesting wildlife of cover
- increases the number of objects thrown by mowers (objects thrown by mowers represent about 12 percent of all claims against the department each year).

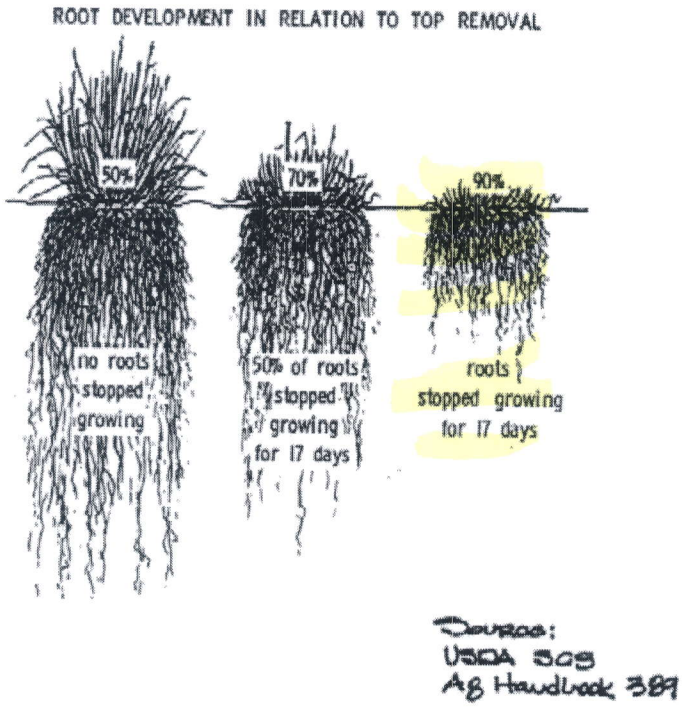

Figure 2-16. Example of root development in relation to top removal.

Coordinate Mowing with Grass Seed Production

Effective mowing operations require coordination with seasonal cycles, as well as with other roadside maintenance activities.

In late summer and early fall, grasses produce seed-heads. Seed-heads develop very rapidly and, if cut, will regenerate in eight to 12 days. Mowing operations during seed-head production result in wasted time and money.

After seed-heads mature in October and November, grasses will become dormant. Mowing after this period will result in a clean right of way until spring.

NOTE: Where K.R. bluestem, Little Bluestem, Sideoats Grama, Indian Grass, Switchgrass, Green Sprangletop, Sand Bluestem, Western Wheatgrass, or Plains Bristlegrass are the predominant grass, they should be mowed in the late fall.

NOTE: Remember to cut grass no less than seven inches high to provide residual material to protect next year's early ground-nesting wildlife and ensure healthy grass regeneration. Panhandle roadsides, for example, provide much needed protective cover for pheasants with proper management of key backslopes. (The backslope is the area of right of way beyond the drainage ditch that slopes away – either up or down – from the plane of the roadway.)

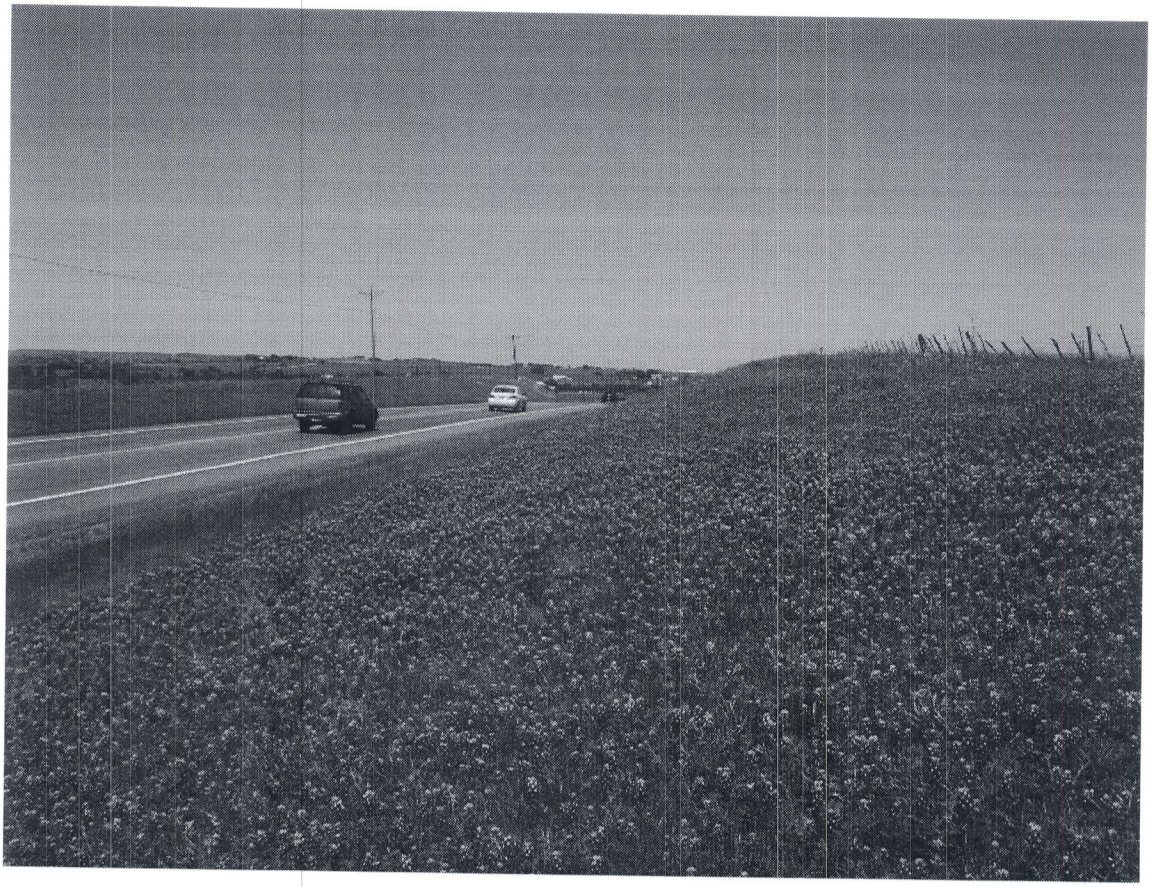

Figure 2-17. Beautiful right of way, mowing operations coordinated in Waco District.

Section 7: Non-Mow or Natural Areas and Acreage Evaluations

Introduction

Each district maintenance engineer, vegetation manager or designated representative must evaluate all unpaved sections of right of way to establish non-mow or natural areas and calculate acreage to be mowed. The department encourages consultation with the Texas Parks and Wildlife Department (TPWD) field biologists to maximize the wildlife habitat benefits on a local basis.

Establishing Non-Mow or Natural Areas

Maximize the designation of non-mow or natural areas throughout the right of way. Suitable non-mow or natural areas may include steep slopes, wide rights of way, and other areas which are covered with desirable vegetation. Clearly mark these areas to prevent accidental mowing during modified full-width mowing.

Calculating Acreage to be Mowed

In addition to the establishment of non-mow areas, the amount of modified full-width and strip acreage to be mowed must be calculated in whole acre units for each section of roadway. These figures will be used in drawing up contact bid proposals and determining maintenance costs.

The Maintenance Management Information System (MMIS) Users Manual, Chapter 2, Section 2 ("Acre Calculation Chart") contains a table for calculating mowing area, shown here as Figure 2-18.